What is claimed is:

1. A wireless communication device, comprising:

a first synthesizer for generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers;

a transmitter for transmitting the first RF signal;

a receiver for receiving a second RF signal from a remote wireless device phase locked with the first wireless device, the second RF signal including a sequence of carriers corresponding to the carriers of the first RF signal, wherein the frequencies of the corresponding sequence of carriers of the first RF signal are different from the frequencies of the sequence of carriers of the second RF signal;

a second synthesizer for generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the first and second RF signals, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the sequence of carriers of the second RF signals are the same as the frequencies of the sequence of carriers of the third RF signal;

a phase detector for comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal and generating a sequence of phase offsets; and

a processor for determining distance between the wireless communication device and the remote wireless device by calculating an estimated slope of the sequence of phase offsets relative to the frequencies of the sequence of carriers of the second RF signal.

2. The wireless communication device according to claim 1, wherein the sequence of carriers produced by the synthesizer are modulated with a modulation signal, and wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

3. The wireless communication device according to claim 2, wherein the wireless communication device further comprises:

a local oscillator for generating a reference signal used to synchronize the first and second synthesizer, and

a frequency divider for dividing the reference signal to generate the modulation signal.

4. The wireless communication device according to claim 1, wherein the phase detector comprises:

a first mixer for mixing the sequence of carriers of the third RF signal with the corresponding sequence of carriers of the received second RF signal, wherein the first mixer outputs a sequence of DC in-phase components I,

a phase shifter for shifting the phase of the sequence of carriers of the third RF signal by 90 degrees, and

a second mixer for mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal, wherein the second mixer outputs a sequence of DC quadrature-phase signals Q, wherein the I and Q components are used to calculate the phase offsets of each of the sequence of carriers of the second RF signal, and wherein the phase offsets are used to calculate the distance between the wireless communication device and the remote wireless device.

5. The wireless communication device of claim 1, wherein the phase detector generates the phase offsets by producing In-phase (I) and Quadrature (Q) signals by mixing the received second RF signal with the third RF signal, and the processor solves for phase angle Θ by applying the following relationship: $\Theta = \text{Arctan}(Q/I)/2$.

6. The wireless communication device according to claim 5, wherein the processor calculates the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

7. The wireless communication device of claim 6, wherein the following relationships are used by the processor to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T := m/2\pi$, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

8. The wireless communication device of claim 1, wherein the wireless communication device transmits information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

9. The wireless communication device of claim 1, wherein the wireless communication device and the remote wireless device transfer data to each other to complete a commercial transaction.

10. The wireless communication device of claim 1, wherein the wireless communication device determines its location based on the calculated distance from the remote wireless device.

11. A wireless communication device, comprising:

a first synthesizer for generating a first radio frequency (RF) signal, the first RF signal including a single carrier having a frequency ft0;

a transmitter for transmitting the first RF signal;

a receiver for receiving a second RF signal from a remote wireless device phase locked with the first wireless device, the second RF signal including a sequence of carriers , wherein the

frequencies of the sequence of carriers of the second RF signal are different from fi0;

a second synthesizer for generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the second RF signal, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the corresponding sequence of carriers of the second RF signal are the same as the frequencies of the corresponding sequence of carriers of the third RF signal ;

a phase detector for comparing the phase of each of the carriers of the second RF signal to the phase of each of the carriers of the third RF signal to generate a corresponding sequence of phase offsets; and

a processor for determining distance between the wireless communication device and the remote wireless device by calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal.

12. The wireless communication device according to claim 11, wherein the sequence of carriers produced by the synthesizer are modulated with a modulation signal.

13. The wireless communication device according to claim 12, wherein the wireless communication device further comprises:

a local oscillator for generating a reference signal used to synchronize the first and second synthesizers, and

a frequency divider for dividing the reference signal to generate the modulation signal.

14. The wireless communication device according to claim 11, wherein the phase detector comprises:

a first mixer for mixing the sequence of carriers of the third RF signal with the corresponding sequence of carriers of the received second RF signal, wherein the first mixer outputs a sequence of DC in-phase components I,

a phase shifter for shifting the phase of the sequence of carriers of the third RF signal by 90 degrees, and

a second mixer for mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal, wherein the second mixer outputs a sequence of DC quadrature-phase signals Q, wherein the I and Q components are used to calculate the phase offsets of each of the sequence of carriers of the frequency-converted second RF signal, and wherein the phase offsets are used to calculate the distance between the wireless communication device and the remote wireless device.

15. The wireless communication device of claim 11, wherein the phase detector generates the phase offsets by producing In-phase (I) and Quadrature (Q) signals by mixing the received second RF signal with the third RF signal, and wherein the processor solves for phase angle Θ by applying the following relationship: $\Theta = \text{Arctan}(Q/I)/2$.

16. The wireless communication device according to claim 15, wherein the processor calculates the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

17. The wireless communication device of claim 16, wherein the following relationships are used by the processor to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T := m/2\pi$, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

18. The wireless communication device of claim 11, wherein the wireless communication

device transmits information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

19. The wireless communication device of claim 11, wherein the wireless communication device and the remote wireless device transfer data to each other to complete a commercial transaction.

20. The wireless communication device of claim 11, wherein the wireless communication device determines its location based on the calculated distance from the remote wireless device.

21. A half-duplex wireless communication device, comprising:

a synthesizer for generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers f_n, where n is a plurality of integers;

a transmitter for transmitting the first RF signal during a first time slot An;

a receiver for receiving a second RF signal, during a second time slot Bn, from a remote wireless device phase locked with the first wireless device, the second RF signal including a sequence of carriers f_n corresponding to the carriers of the first RF signal, wherein the sequence of carriers of the first RF signal are the same as the sequence of carriers of the second RF signal, and wherein the first and second time slots alternatingly repeat as n changes;

a phase detector for comparing the phase of each of the carriers of the second RF signal to the phase of each of the carriers of the first RF signal to generate a corresponding sequence of phase offsets; and

a processor for determining distance between the wireless communication device and the remote wireless device by calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal.

22. The wireless communication device according to claim 21, wherein the sequence of carriers produced by the synthesizer of the wireless communication device are modulated with a modulation signal, and wherein the phase of the modulation signal is coherent with each of the

phases of the sequence of carriers of the first RF signal.

23. The wireless communication device according to claim 22, wherein the wireless communication device further comprises:

a local oscillator for generating a reference signal used to synchronize the synthesizer, and a frequency divider for dividing the reference signal to generate the modulation signal.

24. The wireless communication device according to claim 21, wherein the phase detector comprises:

a first mixer for mixing the sequence of carriers of the first RF signal with the corresponding sequence of carriers of the received second RF signal, wherein the first mixer outputs a sequence of DC in-phase components I,

a phase shifter for shifting the phase of the sequence of carriers of the first RF signal by 90 degrees, and

a second mixer for mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal, wherein the second mixer outputs a sequence of DC quadrature-phase signals Q, wherein the I and Q components are used to calculate the phase offsets of each of the sequence of carriers of the second RF signal, and wherein the phase offsets are used to calculate the distance between the wireless communication device and the remote wireless device.

25. The wireless communication device of claim 21, wherein the phase detector generates the phase offsets by producing In-phase (I) and Quadrature (Q) signals by mixing the received second RF signal with the first RF signal, and wherein the processor solves for phase angle Θ by applying the following relationship: $\Theta = \text{Arctan}(Q/I)/2$.

26. The wireless communication device according to claim 25, wherein the processor calculates the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$\phi(n) := 0$ if $n=0$;

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

27. The wireless communication device of claim 26, wherein the following relationships are used by the processor to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T := m/2\pi$, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

28. The wireless communication device of claim 27, wherein the wireless communication device transmits information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

29. The wireless communication device of claim 21, wherein the wireless communication device and the remote wireless device transfer data to each other to complete a commercial transaction.

30. The wireless communication device of claim 21, wherein the wireless communication device determines its location based on the calculated distance from the remote wireless device.

31. A computer readable medium containing program instructions for controlling a wireless communication device and for determining distance between the wireless communication device and a remote wireless device, comprising instructions for:

generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the wireless communication device, the second RF signal including a sequence of carriers corresponding to the carriers of the first RF signal, wherein the frequencies of the sequence of carriers of the first RF signal are different from the frequencies of the sequence of carriers of the second RF signal;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the first and second RF signals, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the sequence of carriers of the second RF signal are the same as the frequencies of the sequence of carriers of the third RF signal ;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device.

32. The computer readable medium of claim 31, further comprising instructions for modulating the sequence of carriers produced by the first synthesizer of the wireless communication device with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

33. The computer readable medium of claim 32, further comprising instructions for:

generating a reference signal used to synchronize the first and second synthesizers, and dividing the reference signal to generate the modulation signal.

34. The computer readable medium of claim 31, further comprising instructions for:

mixing the sequence of carriers of the third RF signal with the sequence of corresponding carriers of the received second RF signal to generate a sequence of DC in-phase components I,

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees, and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q,

calculating the phase offsets of each of the carriers of the second RF signal using the I and Q components, and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

35. The computer readable medium of claim 31, further comprising instructions for:

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals,

solving for phase angle Θ by applying the following relationship: $\Theta = \mathrm{Arctan}(Q/I)/2$, and

calculating the phase offset based on phase angle Θ.

36. The computer readable medium of claim 35, further comprising instructions for calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

37. The computer readable medium of claim 36, wherein the instructions use the following relationships to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T := m/2\pi$, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless

communication device and the remote wireless device.

38. The computer readable medium of claim 31, further comprising instructions transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

39. The computer readable medium of claim 31, further comprising instructions transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on the distance between the wireless communication device and the remote wireless device.

40. The computer readable medium of claim 31, further comprising instructions for determining the location of the wireless communication device based on the calculated distance from the remote wireless device.

41. A computer readable medium containing program instructions for controlling a wireless communication device and for determining distance between the wireless communication device and a remote wireless device, comprising instructions for:

generating a first radio frequency (RF) signal, the first RF signal including a single carrier having a frequency ft0;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the remote wireless device, the second RF signal including a sequence of carriers, wherein the frequencies of the corresponding sequence of carriers of the second RF signal are different from ft0;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the second RF signal, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the corresponding sequence of carriers of the second RF signal are the same as the corresponding sequence of carriers of the third RF signal;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal. wherein the distance between the wireless communication device and the remote wireless device is proportional to the slope.

42. The computer readable medium of claim 41, further comprising instructions for modulating the sequence of carriers produced by the synthesizer with a modulation signal.

43. The computer readable medium of claim 44, further comprising instructions for:

generating a reference signal used to synchronize the synthesizer, and

dividing the reference signal to generate the modulation signal.

44. The computer readable medium of claim 41, further comprising instructions for:

mixing the sequence of carriers of the third RF signal with the corresponding sequence of carriers of the received second RF signal and outputting a sequence of DC in-phase components I,

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees,

mixing the sequence of 90 degree phase-shifted carriers with the sequence of carriers of the received second RF signal and outputting a sequence of DC quadrature-phase signals Q,

calculating the phase offsets of each of the sequence of carriers of the second RF signal by using the I and Q components, and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

45. The computer readable medium of clam 41, further comprising instructions for:

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals,

solving for phase angle Θ by applying the following relationship: $\Theta = \text{Arctan}(Q/I)/2$, and

generating the phase offsets based on the phase angle Θ.

46. The computer readable medium of claim 41, further comprising instructions for calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

47. The computer readable medium of claim 46, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote wireless device: D: = cT, with c: = 3 x 10^8 m/s and T:= m/2π, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

48. The computer readable medium of claim 41, further comprising instructions for transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

49. The computer readable medium of claim 41, further comprising instructions for transferring data to between the wireless communication device and the remote wireless device to complete a commercial transaction based on the calculated distance.

50. The computer readable medium of claim 41, further comprising instructions for determining the location of the wireless communication device based on is calculated distance from the remote wireless device.

51. A computer readable medium containing program instructions for controlling a half-duplex wireless communication device and for determining distance between the wireless communication device and a remote wireless device, comprising instructions for:

generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers f_n, where n is a plurality of integers;

transmitting the first RF signal during a first time slot An;

receiving a second RF signal, during a second time slot Bn, from a remote wireless device phase locked with the first wireless device, the second RF signal including a sequence of carriers f_n corresponding to the carriers of the first RF signal, wherein the frequencies of the sequence of carriers of the first RF signal are the same as the frequencies of the sequence of carriers of the second RF signal, and wherein the first and second time slots alternatingly repeat as n changes;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the carriers of the first RF signal to generate a corresponding sequence of phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal to determine the distance between the wireless communication device and the remote wireless device.

52. The computer readable medium of claim 51, further comprising instructions for:

modulating the sequence of carriers produced by the synthesizer with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

53. The computer readable medium of claim 52, further comprising instructions for:

generating a reference signal used to synchronize the synthesizer, and

dividing the reference signal to generate the modulation signal.

54. The computer readable medium of claim 51, further comprising instructions for:

mixing the sequence of carriers of the first RF signal with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC in-phase components I,

shifting the phase of the sequence of carriers of the first RF signal by 90 degrees, and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q,

calculate the phase offsets of each of the sequence of carriers of the second RF signal by using I and Q components, and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

55. The computer readable medium of claim 51, further comprising instructions for:

mixing the received second RF signal with the first RF signal to produce In-phase (I) and Quadrature (Q) signals,

solving for phase angle Θ by applying the following relationship: $\Theta = \mathrm{Arctan}(Q/I)/2$, and

generating the phase offset based on the phase angle Θ.

56. The computer readable medium of claim 55, further comprising instructions for calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

57. The computer readable medium of claim 56, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote

wireless device: D:= cT, with c:= 3 x 10^8 m/s and T:= m/2π, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

58. The computer readable medium of claim 51, further comprising instructions for transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

59. The computer readable medium of claim 51, further comprising instructions for transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on distance.

60. The computer readable medium of claim 51, further comprising instructions for determining the location of the wireless communication device based on its calculated distance from the remote wireless device.

61. A method of determining distance between a wireless communication device and a remote wireless device, the method comprising the steps of:

generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the wireless communication device, the second RF signal including a sequence of carriers corresponding to the carriers of the first RF signal, wherein the frequencies of the sequence of carriers of the first RF signal are different from the frequencies of the sequence of carriers of the second RF signal;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the first and second RF signals, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the sequence of

carriers of the second RF signal are the same as the frequencies of the sequence of carriers of the third RF signal ;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device.

62. The method according to claim 61, further comprising the step of modulating the sequence of carriers produced by the first synthesizer of the wireless communication device with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

63. The method according to claim 62, further comprising the steps of:

generating a reference signal used to synchronize the first and second synthesizers, and

dividing the reference signal to generate the modulation signal.

64. The method according to claim 61, wherein the step of comparing phases further comprises the steps of:

mixing the sequence of carriers of the third RF signal with the sequence of corresponding carriers of the received second RF signal to generate a sequence of DC in-phase components I,

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees, and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q,

calculating the phase offsets of each of the carriers of the second RF signal using the I and Q components, and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

65. The method of claim 61, further comprising the steps of:

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals,

solving for phase angle Θ by applying the following relationship: $\Theta = \text{Arctan}(Q/I)/2$, and

calculating the phase offset based on phase angle Θ.

66. The method of claim 65, further comprising the step of calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

67. The method of claim 66, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T := m/2\pi$, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

68. The method of claim 61, further comprising the step of transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

69. The method of claim 61, further comprising the step of transfer data between the wireless communication device and the remote wireless device to complete a commercial transaction

based on the distance between the wireless communication device and the remote wireless device.

70. The method of claim 61, further comprising the step of determines the location of the wireless communication device based on the calculated distance from the remote wireless device.

71. A method of determining distance between a wireless communication device and a remote wireless device, comprising the steps of:

generating a first radio frequency (RF) signal, the first RF signal including a single carrier having a frequency ft0;

transmitting the first RF signal;

receiving a second RF signal from a remote wireless device phase locked with the remote wireless device, the second RF signal including a sequence of carriers, wherein the frequencies of the corresponding sequence of carriers of the second RF signal are different from ft0;

generating a third RF signal, the third RF signal including a sequence of carriers corresponding to the carriers of the second RF signal, wherein the phase of the third RF signal is coherent with the phase first RF signal, and wherein the frequencies of the corresponding sequence of carriers of the second RF signal are the same as the corresponding sequence of carriers of the third RF signal;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the corresponding carriers of the third RF signal to generate a sequence of phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal. wherein the distance between the wireless communication device and the remote wireless device is proportional to the slope.

72. The method of claim 71, further comprising the step of modulating the sequence of carriers produced by the synthesizer with a modulation signal.

73. The method of claim 72, further comprising the steps of :

generating a reference signal used to synchronize the synthesizer, and

dividing the reference signal to generate the modulation signal.

74. The method of claim 71, wherein the step of comparing phases further included the steps of:

mixing the sequence of carriers of the third RF signal with the corresponding sequence of carriers of the received second RF signal and outputting a sequence of DC in-phase components I,

shifting the phase of the sequence of carriers of the third RF signal by 90 degrees,

mixing the sequence of 90 degree phase-shifted carriers with the sequence of carriers of the received second RF signal and outputting a sequence of DC quadrature-phase signals Q,

calculating the phase offsets of each of the sequence of carriers of the second RF signal by using the I and Q components, and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

75. The method of claim 71, further comprising the steps of:

mixing the received second RF signal with the third RF signal to produce In-phase (I) and Quadrature (Q) signals,

solving for phase angle Θ by applying the following relationship: $\Theta = \text{Arctan}(Q/I)/2$, and

generating the phase offsets based on the phase angle Θ.

76. The method of claim 75, further comprising the step of calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1)$ otherwise

where Θ_n is the phase offset for each carrier of the received second RF signals.

77. The method of claim 76, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote wireless device: $D := cT$, with $c := 3 \times 10^8$ m/s and $T := m/2\pi$, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

78. The method of claim 71, further comprising the step of transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

79. The method of claim 71, further comprising the steps of transferring data to between the wireless communication device and the remote wireless device to complete a commercial transaction based on the calculated distance.

80. The method of claim 71, further comprising the step of determining the location of the wireless communication device based on is calculated distance from the remote wireless device.

81. A method of determining the distance between a wireless communication device and a remote wireless device using half-duplex communication, the method comprising the steps of:

generating a first radio frequency (RF) signal, the first RF signal including a sequence of carriers fn, where n is a plurality of integers;

transmitting the first RF signal during a first time slot An;

receiving a second RF signal, during a second time slot Bn, from a remote wireless device phase locked with the first wireless device, the second RF signal including a sequence of carriers fn corresponding to the carriers of the first RF signal, wherein the frequencies of the sequence of carriers of the first RF signal are the same as the frequencies of the sequence of

carriers of the second RF signal, and wherein the first and second time slots alternatingly repeat as n changes;

comparing the phase of each of the carriers of the second RF signal to the phase of each of the carriers of the first RF signal to generate a corresponding sequence of phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the sequence of carriers of the second RF signal to determine the distance between the wireless communication device and the remote wireless device.

82. The method of claim 81, further comprising the step of:

modulating the sequence of carriers produced by the synthesizer with a modulation signal, wherein the phase of the modulation signal is coherent with each of the phases of the sequence of carriers of the first RF signal.

83. The method of claim 82, further comprising the steps of:

generating a reference signal used to synchronize the synthesizer, and

dividing the reference signal to generate the modulation signal.

84. The method of claim 81, further comprising the steps:

mixing the sequence of carriers of the first RF signal with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC in-phase components I,

shifting the phase of the sequence of carriers of the first RF signal by 90 degrees, and

mixing the sequence of 90 degree phase-shifted carriers with the corresponding sequence of carriers of the received second RF signal to generate a sequence of DC quadrature-phase signals Q,

calculate the phase offsets of each of the sequence of carriers of the second RF signal by using I and Q components, and

calculating the distance between the wireless communication device and the remote wireless device using the phase offsets.

85. The method of claim 81, further comprising the steps of:

mixing the received second RF signal with the first RF signal to produce In-phase (I) and Quadrature (Q) signals,

solving for phase angle Θ by applying the following relationship: Θ = Arctan(Q/I)/2, and

generating the phase offset based on the phase angle Θ.

86. The method of claim 85, further comprising the step of calculating the slope by executing a phase ambiguity algorithm to produce a relative phase offset ϕ among the carrier frequencies of the received second RF signal such that

$$\phi(n) := 0 \text{ if } n=0;$$

otherwise,

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) + \pi \text{ if } \Theta_n - \Theta_{n-1} < 0$$

$$\phi(n) := (\Theta_n - \Theta_{n-1}) + \phi(n-1) \text{ otherwise}$$

where Θ_n is the phase offset for each carrier of the received second RF signals.

87. The method of claim 86, wherein the following relationships are used to calculate the distance between the wireless communication device and the remote wireless device: D:= cT, with c:= 3 x 10^8 m/s and T:= m/2π, where m is the slope of the relative phase shift (ϕ) v. frequency line and D is the distance between the wireless communication device and the remote wireless device.

88. The method of claim 87, further comprising the step of transmitting information to the remote wireless device based on the distance between the wireless communication device and the remote wireless device.

89. The method of claim 81, further comprising the step of transferring data between the wireless communication device and the remote wireless device to complete a commercial transaction based on distance.

90. The method of claim 81, further comprising the step of determining the location of the wireless communication device based on its calculated distance from the remote wireless device.

91. A method of determining distance between a wireless communication device and a remote wireless device, the method comprising the steps of:

generating a first signal;

transmitting the first signal;

receiving a second signal from the remote wireless device, the second signal including multiple carriers at different frequencies, wherein each of the multiple carriers are phase coherent with the first signal;

performing a phase comparison using phase information of the first signal and the received second signal to generate multiple phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the multiple carriers of the second signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device.

92. The method according to claim 91, wherein the first signal is an RF carrier.

93. The method according to claim 91, wherein the first signal is a modulating signal modulating at least one RF carrier.

94. The method of according to claim 91, wherein the phase comparison step further comprises the steps of:

generating a third signal including multiple carriers phase coherent with the first signal and corresponding in frequency to the multiple carriers of the second signal; and

comparing the phase of the carriers of the third signal to the corresponding carriers of the received second signal.

95. The method of according to claim 91, wherein the phase comparison step further comprises the steps of:

generating a third signal including multiple carriers phase coherent with the first signal and corresponding in number to the multiple carriers of the second signal,

frequency converting the received second signal so that each of the multiple carriers of the received second signal has the same frequency as the corresponding carriers of the third signal; and

comparing the phase of the carriers of the third signal to a phase of the corresponding carriers of the frequency converted received second signal.

96. A wireless communication device, comprising:

a synthesizer for generating a first signal;

a transmitter for transmitting the first signal;

a receiver for receiving a second signal from a remote wireless device, the second signal including multiple carriers having different frequencies;

a phase comparator for performing a phase comparison using phase information of the first signal and the received second signal to generate multiple phase offsets; and

a processor for calculating an estimated slope of the phase offsets relative to the frequencies of the multiple carriers of the second signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device.

97. The device according to claim 96, wherein the first signal is an RF carrier.

98. The device according to claim 96, wherein the first signal is a modulating signal modulating at least one RF carrier.

99. The device according to claim 96, further comprising:

a synthesizer for generating a third signal including multiple carriers that are phase coherent with the first signal and that correspond in frequency to the multiple carriers of the

second signal, wherein the phase comparator compares the phase of the multiple carriers of the third signal to a phase of the corresponding multiple carriers of the received second signal.

100. The device according to claim 96, further comprising:

a synthesizer for generating a third signal including multiple carriers that are phase coherent with the first signal and that correspond in number to the multiple carriers of the second signal; and

a frequency converter for frequency converting the received second signal so that each of the multiple carriers of the received second signal has the same frequency as the corresponding carrier of the third signal, wherein the phase comparator compares a phase of the carriers of the third signal to the corresponding carriers of the frequency converted received second signal.

101. A computer readable medium containing program instructions for controlling a wireless communication device and for determining distance between the wireless communication device and a remote wireless device, comprising instructions for:

controlling a first synthesizer that generates a first signal;

controlling a transmitter that transmits the first signal;

controlling a receiver that receives a second signal from the remote wireless device, the second signal including multiple carriers at different frequencies, wherein each of the multiple carriers of the second signal are phase coherent with the first signal;

controlling a phase comparator that performs a phase comparison using phase information of the first signal and the received second signal to generate multiple phase offsets; and

calculating an estimated slope of the phase offsets relative to the frequencies of the multiple carriers of the second signal, wherein the estimated slope is proportional to the distance between the wireless communication device and the remote device.

102. The computer readable medium according to claim 101, wherein the first signal is an RF carrier.

103. The computer readable medium according to claim 101, wherein the first signal is a modulating signal modulating at least one RF carrier.

104. The computer readable medium according to claim 101, further comprising instructions for:

controlling a second synthesizer to generate a third signal including multiple carriers that are phase coherent with the first signal and that correspond in frequency to the multiple carriers of the second signal; and

controlling the phase comparator to compare the phase of the carriers of the third signal to the corresponding carriers of the received second signal.

105. The computer readable medium according to claim 101, further comprising instructions for:

controlling a second synthesizer to generate a third signal including multiple carriers that are phase coherent with the first signal and that correspond in number to the multiple carriers of the second signal,

controlling a frequency converter to convert the received second signal so that each of the carriers of the received second signal has the same frequency as the corresponding carrier of the third signal; and

controlling the phase comparator to compare the phase of the carriers of the third signal to the corresponding carriers of the frequency converted received second signal.